

## **REMARKS**

This is a full and timely response to the outstanding non-final Office Action mailed July 13, 2004. Reconsideration is respectfully requested in view of the above amendments and following remarks. The word “preventing” after the word “for” in line 1 of claim 5 is inserted as the Examiner suggested. The sentence in lines 1-2 of claim 14 is amended to be consistent with lines 1-2 of claim 31. Moreover, **on page 8, line 26 to page 9, line 2, the anti-reflective layer 306, the barrier layer 305, and the dielectric layer 304 are etched to form the via hole 304a.** **On page 9, lines 11-17, the anti-reflective layer 306 containing nitrogen cannot diffuse into the dielectric layer 304 because of blocking of the barrier layer 305.** Support for the amendment in claim 14, can be found in the figures and the specification of the present invention. No new matter has been added. Accordingly, the rejections under 35 U.S.C 112 have been overcome.

In section 4 (page 3) of the Office Action, the Examiner allows claims 31-43.

### **Rejections under 35 U.S.C 102(e)**

In section 4 (pages 2-3) of the Office Action, the Examiner rejects claims 1-6, and 12-13 under 35 U.S.C 102(e) as being anticipated by Yeh et al. (2004/0087139). Applicant traverses this rejection for at least the reason that Yeh is completely silent as to the prevention of “scum,” which feature is embodied in each independent claim of the present application. In fact, the undersigned performed an electronic search of the entire text of the published application for Yeh, and the work “scum” is nowhere in this document. For at least this reason, the rejection is misplaced and should be withdrawn.

As a separate and independent basis for the patentability of all pending claims, Applicant notes that the claimed invention was both conceived and reduced to practice before the Nov 4, 2002, filing date of Yeh. Consequently, Yeh is not prior art to the present invention. In this regard, the undersigned submits herewith a copy of an invention disclosure form that documents a conception date of the present invention that pre-dates the priority of Yeh. Should the Examiner not withdraw the rejections based on the substantive distinction set forth above, then the Applicant plans to submit a formal Declaration of inventor Tien-I Bao (pursuant to 37 C.F.R. §1.131 (with supporting documentation) that the invention, defined by the present-pending claims, was reduced to practice before Nov 4, 2002.

#### **Cited Art Made of Record**

The cited art made of record has been considered, but is not believed to affect the patentability of the presently pending claims.


#### **CONCLUSION**

In light of the foregoing amendments and for at least the reasons set forth above, Applicant respectfully submits that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

By:

A handwritten signature in black ink, appearing to read "Daniel R. McClure", written over a horizontal line.

Daniel R. McClure

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TSMC INVENTION DISCLOSURE

EMP. NO.	FULL NAME(S) OF INVENTOR(S)		DEPT.	DEPT. CODE	TEL. NO.	SECURITY B TSMC-RESTRICTED
	ENGLISH Ex: Da-Tung Lee	CHINESE Ex: 李大同				FOR USE BY PATENT AFFAIRS DEPARTMENT
009604	Tien-Li Bao	包天一	TFD	2331	70334586	DISCLOSURE NO.:
008774	Lain-Tong Li	李連志	TFD	2331	7033460	TSMC 2000-0856
006931	Shwang-Ming Jeng	鄭雙銘	TFD	2331	7033457	RECEIVED DATE:
003815	Syun-Ming Jang	章勳明	TFD	2331	7033458	(TIME STAMP)

- TITLE OF INVENTION - (ENGLISH ONLY)  
ENGLISH - METHODS TO RESOLVE LK/CU PR SCUM IN VIA AFTER TRENCH PHOTO DEVELOPMENT
- BACKGROUND INFORMATION - CURRENT PRACTICE AND DISADVANTAGES (ENGLISH ONLY)  
1. In via first Cu damascene process, NHx (amine) radicals in etch stop (SiN, SiC), and ARL (SiON) films causes PR scum in via after trench photo development.
- MAIN POINTS OF CLAIM (PLEASE LIST ITEM BY ITEM; 利用何種方法/手段達到目的) (ENGLISH ONLY)  
1. Non-amine or amine barrier for etch stop, ARL to prevent amine radicals diffusion into low K IMD.
- PROBLEM SOLVED OR IMPROVEMENTS OBTAINED BY THIS INVENTION (PLEASE LIST ITEM BY ITEM) (ENGLISH ONLY)  
1. PR scum in via can be largely improved.
- KEYWORD SEARCH FOR PATENT/LITERATURES (ENGLISH ONLY)  
PR scum
- PATENT/LITERATURES SEARCH RESULT (PLEASE SPECIFY SIMILAR PATENT NO. AND LITERATURE CITATION) (ENGLISH ONLY)  
No similar found
- DETAIL DESCRIPTION OF INVENTION (ENGLISH ONLY)  
PR scum in via after trench photo development is a serious problem in CL013 (and below) LowK/Cu process. NHx (amine) based radicals interact with PR is the key mechanism. How to eliminate or block amine radical in IMD becomes one possible solution. There are two amine sources in lowK/Cu damascene IMD deposition. One is etch stop layer, SiN or SiCN, another is anti-reflection layer (ARL) SiON. Here announce several non amine or amine barrier materials to resolve PR scum.

For etch stop, ARL and barrier: SiOx PECVD using silicon source gases: SiH4, Si2H6, SiF4, TEOS, alkyl-silane (alkyl= methyl, ethyl, propyl...) and oxidant gases: O2, CO2, CO, H2O, H2O2 and carrier gases: Ar, He, CH4 mixture, spin-on glass, BARC...

Scheme: 1. Etch stop/lowK IMD/barrier/ARL 2. Etch stop/barrier/lowK IMD/barrier/ARL 3. Etch stop/lowK IMD/ARL 4. Etch stop/barrier/LowK IMD/ARL

ATTACHMENTS:

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WITNESS: THE TWO WITNESSES WHOSE SIGNATURES APPEAR BELOW HAVE READ AND UNDERSTOOD THIS ENTIRE INVENTION DISCLOSURE.	SIGNATURE OF WITNESS	DATE	SIGNATURE OF WITNESS	DATE
		12/7		12/7

DISCLOSURE SUBMITTED BY			
INVENTORS' EMPNO	INVENTORS' NAME	INVENTOR'S SIGNATURE	DATE
009604	包天一		12/7
008774	李連忠		12/7
006931	鄭雙銘		12/7
003816	章勳明		12/7